The horned desert viper’s ability to hunt at night has always puzzled biologists. Though it lies with its head buried in the sand, it can strike with great precision as soon as prey appears. “Sometimes you even see the snake fly up and whirl round in the air to strike a mouse passing behind it,” says Bruce Young, a biologist at Washburn University in Topeka, Kansas.

Now, Young and physicists Leo van Hemmen and Paul Friedel at the Technical University of Munich in Germany have developed a computer model of the snake’s auditory system to explain how the snake “hears” its prey without really having the ears for it.

Although the vipers have internal ears that can hear frequencies between 200 and 1000 hertz, it is not the sound of the mouse scurrying about that they are detecting. “The snakes don’t have external eardrums,” says van Hemmen. “So unless the mouse wears boots and starts stamping, the snake won’t hear it.” Nor are the vipers picking up vibrations through the sand, as they lack sensors on their skin to do so.

The researchers thought that the snake’s jaw might hold the answer. The viper’s lower jaw is extremely flexible, allowing it to swallow small animals in one gulp, and on each side is a thin bone connecting the jaw to the snake’s ears.

The team’s model showed that any vibrations in the ground would rock the jaw very slightly from side to side, which in turn stimulates the ears at just the right frequency range for the snakes to hear. The snake’s brain then processes the time difference between sounds arriving at each ear, says van Hemmen.

According to the model, neurons in the snake’s brain are excited only if signals from both ears reach them simultaneously. So a mouse positioned directly in front of the snake would cause neurons along a line down the middle of the snake’s brain to fire, but a mouse located to the left would excite neurons on the right side of the brain. The position of the excited neurons tells the snake the exact location of the prey.

Kenneth Kardong, a specialist in snake anatomy at Washington State University in Pullman, likes the idea. “Even we humans interpret some sound vibrations that have passed through our skull,” he says, “but the snakes have evolved this ability to an acute level.” Van Hemmen presented the model at the American Physical Society meeting in Denver, Colorado, on 8 March.

Zeeya Merali

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